Elm Street Cemetery Masonry Restoration

Elm Street/Railroad Street
Braintree, MA 02184

PROJECT MANUAL

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Bid Set July 6, 2017

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY THE CONTRACT DOCUMENTS

A. The project includes the historic masonry restoration of the rubble granite stone wall, granite post bases at the cast iron fence, and concrete repair at the concrete curb.

B. The project includes the removal of the steel topper fence on top of the stone wall, and Dutchmen at the fence attachments to the granite cap stones.

1.02 EXAMINATION OF SITE AND DOCUMENTS

A. The Contractor shall visit the site and examine contract documents before submitting a bid. The Contractor shall inspect and be thoroughly familiar with the same and conditions under which work will be carried out.

B. Neither the Owner nor the Architect shall be responsible for errors, omissions and/or charges for extra work arising from the Contractor's failure to familiarize himself with the existing conditions, the contract documents or work to be done under a separate contract.

C. By submitting a bid, the bidder agrees and warrants that the bidder had the opportunity to examine the site and the contract documents, that the bidder is familiar with the conditions and requirements of both and where they require, in any part of the work, a given result to be produced, that the contract documents are adequate and that the bidder will produce the required result.

1.03 CONTRACTOR USE OF PREMISES

A. During the work of construction, the Contractor shall control and limit general access to the Work area so as not to endanger the public or present the risk of damage to the Owner's Property. Security of the site is the responsibility of the Contractor.

1.04 SAFETY AND SECURITY

A. Maintain security of each specific work site at all times. During off-work hours, all work areas shall be securely sealed with plywood and by all other means to prevent vandalism, theft or entry. The localized work site shall be barricaded during off-work hours.

B. Work of this Project shall comply with all Federal, State and local safety regulations concerning project safety. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

C. This project is subject to compliance with Public Law 91-596, "Occupational Safety and Health Act of 1970" (OSHA), with respect to all rules and regulations pertaining to construction, including Volume 36, numbers 75 and 105, of the Federal Register, as amended, and as published by the U. S. Department of Labor.

1.05 CONTRACT CONDITIONS

A. This Contract is subject to applicable State and local laws and all amendments thereto. Where any requirements contained herein do not conform to statutes governing the Work of this Contract, the statutes shall govern.

B. This Project will be constructed for a political subdivision of the Commonwealth of Massachusetts, and is therefore exempt from State Sales and Use Tax. All bids shall be prepared and purchase of materials for the Project made on the basis of such exemption. After execution of the Contract, the Owner will furnish the Contractor with the exemption number to be used.

C. The provisions of the Federal Occupational Safety and Health Act (OSHA) apply to the execution of the Work of this Contract, in addition to all other laws, ordinances, rules, regulations, and orders of any Federal, State, or local public authority bearing on the performance of the Work.

D. Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if, through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon application of either part the Contract shall forthwith by physically amended to make such insertion or correction.

1.06 BUILDING PERMIT

A. The General Contractor shall be responsible for making application, obtaining, and paying for the Building Permit.

END OF SECTION 01010

SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and relevant sections of these Specifications, apply to the work specified in this Section.

1.2 SUMMARY

A. This section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples and other miscellaneous submittals.

1.3 PLANNING AND SCHEDULING

A. The Contractor shall submit to the Owner for its review four (4) copies of a construction schedule indicating his proposed plan to complete the work within the Contract completion time.

B. The construction schedule shall clearly indicate the Contractor's sequencing of the work, and within each sequence the start and finish dates of critical activities and events shall be indicated. Identify each major area of construction for each major portion of the Work. Indicate where each construction activity with a major area must be sequenced or integrated with other construction activities.

1. The Contractor shall indicate on the construction schedule the specific time periods of work elements.
2. Identify in the schedule the key times when events directly effect the Owner's and occupants' use of the building.
3. The Construction Schedule shall be a horizontal bar chart. Provide separate bars for each trade or operation and identify each bar by specification section number.

Update the construction schedule to reflect actual construction activity and issue the updated schedule at each job meeting. The Owner, Architect and the Contractor will jointly review the progress of the work at scheduled job meetings as specified herein. Should this review, in the opinion of the Owner or Architect, indicate that the work is behind the currently approved schedule, the Contractor shall provide a suitable, detailed explanation to the Owner of the steps proposed in order to conform to the construction schedule and shall submit to the Owner for its review, within seven calendar days of the

review, a revised construction schedule for completion of the work remaining within the Contract completion time.

1.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording Information concerning events at the Project site:

1. List of subcontractors at Project site.
2. Count of personnel at the Project site.
3. High and low temperatures and general weather conditions.
4. Accidents.
5. Meetings and significant decisions.
6. Unusual events (refer to special reports).
7. Stoppages, delays, shortages, and losses.
8. Meter readings and similar recordings.
9. Emergency procedures.
10. Orders and requests of authorities.
11. Change Orders received and implemented.
12. Construction Change Directives received.

B. Field Condition Reports: Immediately upon discovery of a difference between field conditions and Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

C. Special Reports: Submit special reports directly to the Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence. When an event of an unusual and significant nature occurs at the Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise the Owner in advance when these events are known or predictable.

1.5 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. The Contractor shall furnish to the Architect shop drawings, product data and/or samples for all work:

1. Where specifically called for in the specifications.

2. Where shop drawings, product data and/or samples are normally submitted for Architect's approval prior to the actual fabrication or installation of the Work.

3. Where specifically requested by the Architect.

B. Submittals shall be clearly identified as to project name, Owner, Architect, Contractor, Subcontractor, Supplier, Manufacturer or Fabricator, and the item's name and location. Shop Drawings shall clearly show all significant details of materials, fabrications, finish, and installation. Product data shall be sufficient to provide full verbal and pictorial description of physical, technical, and performance characteristics, and complete installation instructions. Samples shall be of adequate size to permit proper evaluation and show full range of variations of color, texture, dimensions, and other characteristics that will appear in the finished work. Adequacy of submittals shall be subject to the Architect's approval. Allow sufficient time for processing and review of submittals. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of Work to permit processing.

C. Shop Drawings: The following procedure for submission and approval of shop drawings shall be followed:

1. The Contractor shall receive shop drawings from the various Subcontractors and Suppliers. Contractor shall date-stamp them, make any corrections necessary, highlight any deviations from the Contract Documents, and verify under signature that they have been checked for dimensions, fit, and conformance with Contract Documents. The Contractor shall submit six (4) sets to the Architect.

2. The Architect will check shop drawings for compliance with the design concept of the project and for general compliance with information given in the Contract Documents only.

3. The Contractor shall resubmit shop drawings for approval if requested to do so. Upon approval, Contractor shall

furnish at his own expense all printings of drawings for all trades as required to properly carry out the work.

D. Product Data: The following procedure for submission and approval of descriptive data shall be followed:

1. The Contractor shall receive the descriptive data from the various Subcontractors and Suppliers. The Contractor shall verify under signature on a letter of transmittal that it has been checked for agreement with the Contract requirements.

2. The Architect will review the descriptive data for general compliance with the information given in the Contract Documents only.

E. Samples: The following procedure for submission and approval of samples shall be followed:

1. The Contractor shall receive samples from the various Subcontractors and Suppliers. The Contractor shall verify under signature on a letter of transmittal that they have been checked for agreement with the Contract requirements. The Contractor shall then forward two samples to the Architect for approval, testing, etc. One sample will be retained by the Architect and one sample retained at the Contractor's site office.

2. The Architect will review the samples for general appearance and arrangement and for general compliance with the information given in the Contract Documents only. The Architect will indicate which colors and finishes, or other variable factors within the ranges specified, will be required. The Architect will, within a reasonable time after receipt of samples, notify the Contractor in writing of his acceptance or rejection of samples and basis for his decision. Rejected samples shall be replaced with acceptable materials, as approved by the Architect.

F. It shall be the responsibility of the Contractor to submit shop drawings, product data, and samples in accordance with the above schedules. Failure to do so will not justify a delay in time of completion of the work.

G. Emergency Contacts: The Contractor shall submit to the Owner and Architect a list including the names, addresses and telephone numbers of key members of their organization including Superintendent, Company

Owner, and personnel at the site to be contacted in the event of emergencies at the building site which may occur during non-working hours.

END OF SECTION 01300

SECTION 01500 - CONSTRUCTION FACILITIES & TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 RESPONSIBILITY AND COMPLIANCE

A. All requirements set forth under this Section are directed to the Contractor except where otherwise noted.

B. The Contractor shall be responsible for facilities as specified herein and as required for proper and expeditious prosecution of the work.

C. The requirements of Section 01500 are in addition to, not in lieu of other protection and temporary controls contained elsewhere in these specifications.

1.2 SECURITY AND PROTECTION

A. The building will be occupied during this Contract.

B. Provide and maintain all security precautions and proper protective measures as may be required to adequately protect the building and Owner's personnel, the public, and other interests of the Owner from hazards resulting from or related to the work performed hereunder.

C. Repair any damage to the building or property which takes place during the contract period to the satisfaction of the Owner and Architect.

D. Construct safety barricades and protective facilities in accordance with local and State regulations. Furnish and install all signs, lights, reflectors, and all such protection facilities as may be required.

E. Keep all roads and walks clear of debris, materials and construction equipment during building operations. Repair streets, drives, curbs, sidewalks, fences, poles and the like where disturbed during the construction operations, and leave them in as good condition after completion of the Work as before operations started.

F. Protect all planting, landscaping, trees and site improvements to remain or to be relocated.

G. Remove all snow and ice which may impede the work, damage the finishes or materials or be detrimental to workmen.

H. Contractor shall be responsible for all glass breakage

I. Maintain a weathertight building at all times.

1.3 ACCIDENT PREVENTION

A. Comply with all Federal, State and municipal recommendations and requirements for safety, and accident prevention, and those of the Associated General Contractors of America, and the American Standards Association Standard A10.2. Ensure that the Field Superintendent conducts regular, frequent inspections of the site for compliance with safety regulations.

B. Neither the Owner nor the Architect shall be responsible for providing a safe working place for the Contractor, Subcontractors, or their employees, or any individual responsible to them for the work.

1.4 TEMPORARY ELECTRIC LIGHT AND POWER

A. The General Contractor shall furnish and install all work required to provide adequate light and power during construction. General Contractor shall furnish all temporary wiring, fixtures, and extension, and shall remove them upon completion. The Owner shall pay electric utility costs.

1.5 PREVENTION OF FIRE

A. Before beginning any work on the site, the Contractor shall confer with the Owner's Project Representative and local fire department to outline the precautions which the Contractor proposes to take against fire, including his methods of ensuring that the minimum fire prevention requirements listed herein will be complied with at all times.

B. The Contractor shall take all necessary precautions for the prevention of fire during construction. The Contractor shall be responsible that the area within contract limits is kept orderly and clean and that combustible rubbish is promptly removed from the site. The Contractor shall comply with all official recommendations of the local fire department.

C. The Contractor shall provide and maintain in good working order under all conditions, suitable and adequate fire protection equipment and services.

D. Strict safety precautions shall be observed when burning with a torch or using other open flames. The Contractor shall provide adequate type and number of portable fire extinguishers so that wherever and whenever a torch or open flame is used a fire watch armed with an appropriate fire extinguisher shall be used in accordance with all local authorities.

1.6 TEMPORARY HOISTING EQUIPMENT AND MACHINERY

A. Each Sub-Contractor or trade shall furnish, install, operate, and maintain in safe condition all hoisting equipment and machinery required to properly carry out and complete the Work.

B. All hoisting equipment and machinery, and operation shall comply in all respects to all applicable Federal (including OSHA), State and local laws, rules, regulations, codes and ordinances.

1.7 TEMPORARY STAGING AND SCAFFOLDING

A. The Contractor shall furnish, erect, and maintain in safe condition all exterior staging and scaffolding for his own use as required to properly carry out and complete the Work and for the use of all trades for execution of work over eight feet above ground level. The Contractor shall provide working platforms at the height required by each Sub-Contractor or trade. Relocation of planking as required to access work shall be done by the Sub-Contractor who requires the relocation.

B. Staging and scaffolding shall comply in all respects to all applicable Federal (including OSHA), State and local laws, rules, regulations, codes, ordinances and shall be designed to withstand local wind loading.

1.8 TEMPORARY CONTROLS

A. Dust, Noise and Pollution Control: Protect the public from dust, noise and pollution. All work shall comply with applicable Federal, State and local codes.

B. Debris Collection and Removal: The Contractor shall provide a dumpster on site throughout construction for use by all Sub-Contractors and trades. Prevent the accumulation of rubbish or debris at the site. Schedule collection and legal off-site disposal of all dumpsters in order to keep the site clean. Prevent dumpsters from damaging paved areas. No dumpsters shall be placed on non-paved areas.

1.9 OVERLOADING

A. Do not permit any section of the building, staging or scaffolding to be loaded beyond designed live loads.

END OF SECTION 01500

SECTION 01520 - STAGING, LIFTS AND ACCESS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

The general provisions of the Contract, including General and Supplementary Conditions, and all Division 1 sections of the Specifications apply to the work specified in this section.

1.2 SCOPE

A. All staging, stairs, hoisting, rigging, lifts and access required to complete the work shall be provided as follows:

1. The General Contractor (referred to as Contractor) shall provide all staging, stairs, hoisting, rigging and access at the exterior of the building up to a working level at the eave line, including the eave line of the tower.

B. The Contractor is responsible for obtaining and paying for permits, erecting and maintaining, in safe condition, all scaffolding, stairs and hoisting, and associated equipment required on the job. All work shall comply with OSHA requirements and the requirements of all applicable state and local laws, codes, regulations and ordinances. Specifically, the Contractor must designate a safety supervisor who is familiar with OSHA Publications 2202, 3077, and 3072, and those which concern construction industry safety standards, personal protective equipment, and sling safety and labor. No swing staging shall be permitted without specific written approval of the Owner.

C. The Contractor shall control access to the work area and prevent unauthorized access to the work area and any area where there is danger from falling objects. The Contractor shall control access to the fenced side yards and enclose the work area with an eight (8) foot (min.) height chain link fence as required to protect the public. Posts for the fence shall be installed into the ground in both paved and lawn areas. The enclosed area shall be kept locked at all times except when workmen are at the site and have direct control over the construction area. 8 sets of duplicate keys shall be provided to the owner for all Contractor secured areas. Patch post penetrations to match adjoining material upon removal of enclosure fence.

Adjoining windows, roof and building surfaces shall be protected by the Contractor. The adjoining parking lot and walkways must be protected from falling dust, paint removal process, and general debris.

The Contractor shall allow access by the trades and coordinate scheduling and use.

1.3 SUBMITTALS

A. The Contractor shall submit certification that the staging meets OSHA and applicable regulations and requirements.

B. The Contractor shall be responsible for grounding the staging in compliance with UL requirements.

C. The Contractor shall submit a written safety plan to the owner with detail for full protection along with a list of onsite competent persons.

D. The Contractor shall submit a written schedule and work proposal identifying the proposed sequencing and coordination of the sub-trades' use of staging.

END OF SECTION 01520

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SUMMARY

A. The following are prerequisites to issues of Certificate of substantial completion. Provide the following:

1. Punch list.
2. Supporting documentation.
3. Certifications.
4. Warranties

B. Provide the following requisites to final acceptance:

1. Final payment request with supporting affidavits.
2. Completed punch list.
3. Consent of Surety for Final Payment
4. Release of Liens
5. AIA forms 706, 706G, 707
6. Certified payrolls
7. All warranty and close out documents
8. MBE/WBE where required

C. Provide the following close out procedures:

1. Final cleaning and touch-up.
2. Removal of temporary facilities, including all restoration and repair work required.

PART 2 - PRODUCTS. (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION 01700

SECTION 02050 – SELECTIVE DISMANTING AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, and relevant sections of these Specifications, apply to the work specified in this Section.

1. Section 04500 – Masonry Restoration

1.2 INCLUDED IN THIS SECTION

A. Dismantling and demolition of designated, loosened and shifted masonry elements for reconstruction and repair.

B. Removal of the steel topper fence from the granite wall.

1.3 REFERENCES

A. Comply with Massachusetts Department of Public Works (MDPW) Standard Specifications for Bridges, Demolition Requirements.

B. Comply with all applicable requirements of other sections.

1.4 SUBMITTALS

A. Submit certificates attesting to legal disposal of refuse materials if requested by the engineer.

1.5 PROTECTION

A. Provide for the uninterrupted safety of workers and adjacent structures to remain as well as the general public during all phases of the work. Provide warning signs, and barricades as required to maintain a separated, safe, secure site.

B. Protect all elements that are to remain and all historic elements to be retained and/or re-set. Do not dismantle anything other than what is specifically indicated on the contract documents unless specifically requested to do so in writing by the Engineer.

PART 2 - PRODUCTS AND MATERIALS

2.1 PRODUCTS AND MATERIALS:

A. Provide products and materials which are incidental to the dismantling and demolition work, disposing of these or salvaging them for re-use as best suits the project conditions.

2.2 BACKFILL

A. The contractor shall provide suitable backfill where needed to temporarily fill holes of voids left by removal of partially buried items that are to be re-erected.

PART 3 - EXECUTION

3.1 SITE REVIEW:

A. Perform full review of site to verify extent of dismantling and to plan for coordination with other trades.

3.2 OPERATIONS

A. Carefully study each item to be dismantled or demolished and determine the safest, least disturbing and potentially damaging method of disassembly.

B. Where items are to be reassembled, number the items, photograph them and make a sketch of assembled items for re-use during re-assembly. Number each component with an appropriate non-permanent method of marking, and note the points of contact or intersection and their orientation. Take photographs of all elements to be worked on before and after the work.

C. Notify the Engineer immediately if any damage has occurred to any of the dismantled items and propose appropriate methods of repair.

END OF SECTION 02050

SECTION 02210 - TEMPORARY SHORING, BRACING AND PROTECTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Detailing and installation of all required temporary shoring, bracing and support to enable the specified masonry reconstruction and restoration to be completed in a safe and expedient manner.

1.2 REFERENCES

A. Comply with the standard material specifications that apply to the materials used and manufacturer's instructions

1.3 SUBMITTALS

A. Submit the following items to the Engineer for review:

1. Drawings showing shoring, bracing, and temporary supports.
2. A written sequence of all phases of restoration operations and related temporary support.

1.4 QUALITY ASSURANCE

A. Comply with all referenced standards for the products employed.

B. Schedule all appropriate site visits and inspections.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS

A. Products and materials that are appropriate to the application and permitted by the Massachusetts State Building Code.

PART 3 - EXECUTION

3.1 TEMPORARY SHORING, BRACING AND PROTECTION

A. The contractor shall be solely responsible for all means and methods of construction employed on this project including all temporary bracing, support and protection of the existing Structure. Contractor shall be prepared to retain the services of a Massachusetts- registered professional structural engineer at his own expense if necessary in order to maintain safe and stable conditions on the project. Any sequences of work or methods indicated or implied in the contract documents are present only as assumptions on which the design of the permanent installations are based and are to be considered as a suggested option for review by the contractor.

B. Field Survey and Analysis:

1. Field verify indicated shoring locations and measure all existing geometry and note existing conditions. Locate points of attachment and support that will best suit progress of work.

2. Perform a structural analysis of the areas to be affected by the work and determine loads on temporary shoring, bracing and support system.

C. Design Shoring, Bracing and Protection:

1. Shoring and bracing shall be designed to maintain existing lines and surfaces without deflection during work. Design shall be in accordance with gravity dead, live and wind load resistance requirements of the Massachusetts State Building Code and referenced standards.

2. Shoring and bracing shall be sufficient for existing and new material loads and anticipated construction loads.

3. Shoring and bracing shall allow for distribution of loads to supporting structure and shall limit all movement to less than 1/16" at full loading. Stresses on supporting structure shall not exceed safe, commonly allowable stresses for the materials in consideration of their age and conditions. Bending members shall allow deflections of not more than the span lengths divided by 720 at full loading. Protection shall be detailed to protect the remaining structure, its contents, and the immediate environs against damage from falling projectiles, debris and/or soiling that is related to or a result of any of the operations that are part of this project. This shall include barricades, shields, tarpaulins, scrims and restraining devices, along with any other devices and structures as may be needed to provide safe protection. All structures shall be detailed and constructed to withstand all possible live, snow, wind and impact loads without failure.

D. Construct shoring, bracing and protection in accordance with approved submittals and proper and standard construction practice. Work shall be installed so as not to permanently mar or stain the exposed stone faces of the structure.

E. Maintenance: Maintain shoring, bracing and support in a safe condition during all phases of work. Keep wood generally dry and at constant moisture content. Protect wood from swelling or shrinking with weather and humidity fluctuations.

F. Removal: Remove all shoring and bracing after surrounding work is complete and masonry has adequately cured to support itself. Remove all temporary inserts and clean all contact surfaces and plug all holes per applicable requirements of Section 04500 -Masonry Restoration.

END OF SECTION 02210

SECTION 04500 - MASONRY RESTORATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, and relevant sections of these Specifications, apply to the work specified in this Section.

1. Section 02050 - Structural Dismantling and Demolition
2. Section 02210 - Shoring, Bracing and Protection

1.2 QUALIFICATIONS

1.3 SCOPE OF WORK

A. The Work shall include all masonry work, the nature and quantities of which are detailed and described herein and on the contract drawings.

1. Localized repair of existing back-up construction to remain.
2. Documentation, removal and re-setting of stonework.
3. Cutting and pointing of stonework.
4. Cleaning of all Masonry
5. Replacement of pre-cast concrete curb
6. Concrete repairs to precast concrete curbs to remain.
7. Removal of steel topper fence.
8. Installation of granite Dutchmen at steel topper fence attachment locations.
9. All work which is not assigned to other specification sections.

1.4 REFERENCES

A. Comply with the following standard material specifications:

1. ASTM C141- Hydrated Hydraulic Lime
2. ASTM C144 - Sand for Mortar and Grout
3. ASTM C270 - Mortar and Mortar Testing for Unit Masonry
4. ASTM C1713 – Mortars for the Repair of Historic Masonry
5. ASTM A276, Type 316 - Threaded Round Stainless Steel Bar Stock.
6. ASTM C144 - Sand for Mortar and Grout
7. ACI 530 - Building Code Requirements for Masonry Structures.
8. ACI 530.1 - Specifications for Masonry Structures.
9. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Cold Weather Masonry Construction.
10. UL - Fire Resistance Directory.

1.5 SUBMITTALS

A. Submit the following items to the Engineer for review

1. Test reports required as per paragraph 1.5 - Quality Control.
2. Product Data: Submit manufacturers' technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.
3. Product data sheets and samples.
4. Mortar mix design where needed.

B. Submit shop drawings and samples for all masonry fabrications.

1. Replacement stone sample where appropriate.

C. Perform field-constructed mock-ups for review by the Architect:

1. Samples of new structural pointing and patching mortars and grouts cured in same fashion as will be applied to structure.

2. 24"x24" raking (joint cutting) test/sample patches for (as preparation for repointing work) to be provided by the Contractor at exterior and interior wall surfaces and located as agreed with Architect on site. No raking or joint cutting shall be started until samples are approved.

3. 24"x24" pointing / repointing test/sample patches to be provided by the Contractor at stone wall and concrete curb, located at agreed with the Architect on site. No repointing shall be started until samples are approved.

4. 24"x24" cleaning samples of each type of masonry.

5. 24" x 24" sample of rebuilt and reset masonry

6. Work that does not match the approved sample panels shall be rejected and redone. The Contractor shall be responsible for producing as many sample panels as necessary to provide a match of existing adjacent work that meets the satisfaction of the Architect.

1.6 QUALITY CONTROL

A. Comply with all referenced standards for the products employed.

B. Comply with requirements of Massachusetts State Building Code.

C. Coordinate times of Special Inspections to comply with Massachusetts State Building Code.

D. All masonry work shall be performed by individuals with more than ten year well-referenced experience with historic stone masonry restoration.

E. During periods of cold or questionable weather, keep a log of work including air temperature and weather conditions, work started and completed per day, and tests taken. No work shall be done when the ambient temperature of the structure or the air is less than 45 degrees F.

F. Produce mortar and grout samples in the form of 2" x 2" x 2" flat slabs, placed against wooden side forms and backing, for easy removal of cured sample. Provide 8 samples per mortar and grout type taken on different days and cured under conditions that match field conditions to testing laboratory for compression testing. Provide at least four 2" x 2" x 2" field cut samples of existing mortar to the testing laboratory for comparative compression testing. Contractor shall arrange for and pay for all testing and shall submit results at 7 days and at 28 days to the Engineer. Adjustments in mix and re-tests shall be made as required at no additional cost to the owner. Test existing mortar samples and trial mixes at least three weeks before commencing masonry work.

G. Mortar colors and textures shall match existing cleaned stone and mortar surfaces. The contractor shall prepare an area of sufficient size to demonstrate the finish of tuck pointing mortar between the stones and stone filler mortar on the stones.

H. Controls: The controls for the above treatments shall be the approved mock ups as defined in this specification section as well as related sections.

I. Contractor: Work must be performed by a mason that has completed large scale, complex masonry restoration projects that demonstrate the mason's ability to successfully complete the project. Provide names of the qualifying projects, contact information, date completed and description of scope as well as the duration of the contract. Provide photographs of the completed projects. In addition, contractor is to:

1. List all masonry restoration projects completed during the last (5) years where the masonry restoration contract value exceeds two hundred and fifty thousand dollars. Provide names of the qualifying projects, contact information, date completed and description of scope as well as the duration of the contract.

2. Provide documentation that they have successfully supplied and installed stone units for large scale and complex masonry restoration projects. Provide names of the qualifying projects, contact information, date completed and description of scope as well as the duration of the contract. Provide photographs.

3. Provide documentation that they have been in business for at least (ten) ten years and have successfully completed masonry restoration projects in the Northeast United States.

4. Provide the percentage of annual work for the past five years that consists of historic preservation projects vs. new construction.

J. Modification: In the event that the contractor wants to modify any of the specified materials or methods, the proposed changes shall be submitted in writing and shall include all pertinent information requested for the specified products and techniques. No modifications shall take place without written approval.

K. Source of materials: Obtain materials for repointing from a single source for each type of material required to ensure a match in quality, color and texture.

L. Mock Up Panels: The contractor shall notify the Architect before beginning masonry restoration. Obtain the Architect's approval of the mockups before proceeding with the work.

M. The contractor shall replace all broken, lost and damaged masonry resulting from repair, repointing or cleaning at no expense to the owner.

N. The contractor shall comply with all relevant ASTM Standards for materials.

O. All work shall comply with the United States Secretary of the Interior Standards for Rehabilitation Guidelines for Rehabilitating Historic Buildings, unless stated otherwise. Repointing basic reference standard shall be National Park Service Preservation Brief Number 2: Repointing Mortar Joints in Historic Brick Buildings, by Robert C. Mack AIA, de Teel Patterson Tiller, and James S. Askins.

P. Do not modify intended aesthetic effects, as judged solely by the Architect, except with Architect's approval, and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Protect mortar and other cementitious materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

C. Restore any damage to site caused by storage, mixing or construction work.

D. Packing and Loading of Materials: Carefully pack and load finished stone for shipment using all reasonable and customary precautions against damage in transit. Do not use any material that may cause staining or discoloration for blocking or packing.

E. Store cementitious materials off the ground, under cover and in dry location.

F. Store aggregates where grading and other required characteristics can be maintained.

G. Protect mortar materials and stone accessories including metal items to prevent deterioration by corrosion and accumulation of dirt.

1.8 SEQUENCING/SCHEDULING

A. Order replacement masonry at the earliest possible date, to avoid delaying completion of the Work.

B. Utilize sequence that best suits the work.

C. The existing exterior masonry is in an unstable state. Schedule work to remove and/or at least brace all unstable masonry elements by the earliest possible opportunity in order to make conditions safe.

1.9 PROJECT CONDITIONS

A. Do not repoint mortar joints or repair masonry unless air temperatures are between 40°F (4°C) and 80°F (27°C) and will remain so for at least 48 hours after completion of work. During periods of questionable weather keep a log of work including air temperature and weather conditions, work started and completed per day and tests taken.

B. Prevent grout or mortar used in repointing and repair work from staining face of surrounding masonry and other surfaces. Remove immediately grout and mortar in contact with exposed masonry and other surfaces.

C. Protection: Protect and maintain all work in a dry safe condition for the duration of the work.

D. Protection of Work: Cover tops of walls with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover in place.

2. Staining: Prevent grout or mortar from staining the face of stone to be left exposed. Remove immediately grout or mortar in contact with such stone.

3. Protect surrounding surfaces from rain-splashed soil and mortar splatter by means of coverings spread on ground and over wall surface. Protect sills, ledges and projections from droppings of mortar.

E. Remove all masonry determined to be frozen or damaged by freezing conditions.

F. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

G. Protection During Cleaning: Protect persons, motor vehicles, construction site and surrounding buildings from injury resulting from stone cleaning work.

1. Protect all non-stone surfaces. Review all protective measures with Engineer.

2. Protect all non-masonry surfaces. Review all protective measures with Architect.

3. Prevent cleaning solutions from coming into contact with pedestrians, motor vehicles, plant materials, buildings and other surfaces that could be injured by such contact.

4. Do not clean stone during winds of sufficient force to spread cleaning solutions to unprotected surfaces.

5. Dispose of run-off from cleaning operations by legal means and in a manner which prevents soil erosion, undermining of paving and foundations, and damage to adjacent landscaping.

1.10 COLD WEATHER PROTECTION

A. Do not perform any wet masonry work when temperature of surrounding area is below 40 degrees F., or below 45 degrees F. and falling, or forecast by public news media to fall to or below 35 degrees F. within 24 hours without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing. Minimum temperature within heated enclosure shall be 40 degrees F. Do not use masonry materials which are likely to contain frost. Do not use accelerating ingredients with any mortar. Mortar shall harden without freezing and with no damage from frost. Protect all work against freezing for not less than 48 hours after installation.

B. Do not lay masonry units that are cold and wet or frozen. Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen setting beds.

C. Comply with requirements of International Masonry All-Weather Council's "Guide Specification for Cold-Weather Masonry Construction". Heat materials and provide temporary protection of completed portions of stone work.

1.11 HOT WEATHER PROTECTION

A. Protect masonry work in hot weather to prevent excessive evaporation of setting beds and grout. Provide artificial shade, wind breaks and use cooled materials as required. Use fresh mortar. Discard mortar that has stiffened due to hydration.

1.12 DEFINITIONS AND GOALS

A. Low-Pressure Spray: 100 to 400 psi; 4 to 6 gpm.

B. Medium-Pressure Spray: 400 to 800 psi; 4 to 6 gpm.

C. High-Pressure Spray: 800 to 1200 psi 4 to 6 gpm.

D. Stone Dutchmen: Theinstallation of a piece of specially fabricated stone to fit the existing opening from the existing steel railing embedments. All stone dutchmen must match the adjacent area of original stone in terms of color, texture and finish. Sizes, locations and method of attachment are to be approved in writing prior to starting any work.

E. Cleaning: The goal of cleaning is to remove surface soiling as well as active and inactive biological growth from the stone. Two rounds of cleaning are required - an initial round to eliminate units that have been removed and a second round to fully clean units that will be reused and reset.

F. Granite Replacement: The goal of granite replacement is to identify cracked, broken or missing units of grabite after the mortar joints have been raked our for repointing and to replace those units with matching pieces of granite, cut/split and/or tooled to match the stone in the adjacent areas.

PART 2 - PRODUCTS

2.1 MASONRY UNITS

A. Replacement granite units will be provided by owner in bulk form, and delivered to the job site. It is the responsibility of the contractor to clean, cut, and form the units to fit each location and match the adjacent masonry finish.

2.2 MORTAR AND GROUT

A. Mortar and Grout Materials:

1. Cement: Type 1 white and/or gray cement as follows: Portland Cement: ASTM C150 complying with staining requirements of ASTM C91 for a low-alkali cement having a maximum of 0.60% equivalent alkalies. Mortar shall show no efflorescence when cast in a 2" x 7" x ½" slab consisting of 1 part of the cement to be used, 2 parts Ottawa plastic mortar sand and distilled water, and subjected to a 7 day "wick test" conforming to ASTM C67.

2. Hydrated Lime: ASTM C207, Type S.

3. Coarse Aggregate For Grout: ASTM C-33, 3/8" dia. minimum gravel or stone.

4. Fine Aggregate / Sand:Sand for mortar and grout: ASTM C144, washed, clean and free of salts. For use in mortar that will be used for pointing that is exposed to public view sand shall match the sand in the original mortar in color, coarseness and gradation, subject to review by the Architect.

5. Water: Potable, clean, free of oils, acids, alkalis and organic matter.

6. Crack Seal for Grout Injection: Mortar pointing to stay in place or removable backer rod or jute.

B. Provide mortar conforming to ASTM C1713 "Proportion Specification" in the formulation(s) as listed below.

1. Provide the following:

   a. Structural mortar for Back-up Masonry Reconstruction and Re-setting shall be 1 part Portland Cement, 3 parts Hydrated Lime and 12 parts Bulked Sand.

   b. Mortar for exposed masonry Resetting or Pointing/ Repointing shall be shall be 1 part Portland Cement, 3 parts Hydrated Lime and 12 parts Bulked Sand. Sand shall be properly selected and blended to match the color, texture and appearance of the existing mortar sand, and when used, Portland Cement shall be a combination of white and gray cement that bests suits the color matching of the existing mortar binder. Where additionally needed, up to 10% by mineral oxide pigment by weight of binder may be added to best match the color of the original mortar. Pigments shall be chemically pure mineral oxides, alkali proof and light fast, and shall be equal or equivalent to "Solomon Grind" as manufactured by Chem Services Inc, of Springfield, IL.

2. The Contractor shall review test data and products with the Architect and any required adjustments shall be made. Contractor shall then submit a record mortar mix design along with product data sheets to the Architect for verification and review before beginning any mixing and/or setting.

C. "Restoration Grout" for filling voided filling cavities, deep joints and joints of greater than ¾" width within stone rubble reconstruction, and for gravity feeding or injecting into stone rubble construction to remain shall be a sanded pozzolan-lime or hydraulic lime grout with shrinkage not to exceed 0.07 %, compressive strength to be between 1,400 and 1,800 psi at 28 days and tensile bond strength to be at least 40 psi as demonstrated by test or specifically documented by manufacturer's literature and shall have a flowability of 135% per ASTM C230. Injectable Restoration Grout shall have maximum sand particle size passing a #70 sieve.

2.3 MORTAR AND GROUT MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C270 in quantities needed for immediate use.

B. Mix grout in accordance with manufacturer's instructions.

C. Mortar colors shall be chosen to match cleaned stone and mortar surfaces. Chemically clean an 18" square area of wall at a location to be designated in the field by the Architect for use in color comparison.

D. Grout shall be mixed in accordance with manufacturers' instructions.

E. The contractor shall review the water content and any required adjustments along with proposed products with the Engineer. Contractor shall then submit a record mortar mix design along with product data sheets to the Engineer for verification, review and approval before beginning any mixing or installation.

2.4 MISCELLANEOUS PRODUCTS

A. Sealant and Backer Rods

1. Provide closed cell backer rod at all sealant joints. Backer rod shall be carefully sized per sealant manufacturer instructions for each joint.

2. Provide 2-component polyurethane complying with ASTM C-920 and Federal Specification TT-S-00227E.

3. Acceptable manufacturers: Equal or equivalent to Sika, Tremco product line.

B. Provide Plastic Shims as needed for initial leveling and floating of stone units into bedding mortar. These shall be a stone-suitable product that is equal or equivalent to those supplied by Korolath of New England, Woburn, MA.

2.5 MORTAR WASHDOWN CLEANER

A. For non-pigmented mortars, use equal or equivalent to "Sure Klean 600 Detergent" as manufactured by ProSoCo Inc.

B. For pigmented mortars use equal or equivalent to "Vana Trol" as manufactured by ProSoCo Inc.

2.6 CHEMICALS FOR CLEANING OF STONE

A. Light duty Restoration Cleaner with the following properties:

1. Appropriate for dense masonry surfaces with low potential for damage to adjacent or surrounding surfaces.
2. Mildly acidic with minimal corrosive effects.
3. Low odor.
4. Environmentally non-damaging effluent.
5. Diluted 1:5 with water.
6. 5 minute dwell time.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS OF THE WORK

A. An effort shall be made to minimize the need for on-site storage of masonry materials, close coordination of the field personnel, material suppliers and the general contractor shall be shall be maintained to provide for a steady flow of materials on a close to as-needed basis.

B. All dismantled work shall be fully documented and the original geometry of the structure (before bulging and sagging) be established. Reconstruction shall be done to replicate original geometry.

C. Inspect all masonry within work areas, identify all required repairs and removals.

D. Perform all other indicated masonry work in accordance with the requirements of this section and all references.

3.2 DOCUMENTATION AND REMOVAL OF DESIGNATED MASONRY

A. Identify the areas where shifted, damaged and/or designated masonry is to be removed, as designated on the Contract Drawings along with any additional areas.

B. Clearly identify all stones that are to be reset by number. Photograph all existing work in place before removal.

C. Evaluate each piece of finished stonework in place and determine the best, most gentle method(s) of removal for each unit. Locate and cut any anchors that are holding the units in place, providing support to the units while the anchors are being detached or cut so that the units do not fall or become stressed. If any of the units are found to be " headered" or irremovably locked into the back-up construction, stop removal work, brace the unit and notify the Engineer of the condition.

D. Provide and install all temporary shoring, bracing and support to surrounding construction before beginning removal. Where appropriate, removal and replacement shall be done sequentially to avoid weakening too much of the structure at one time. Contractor shall be responsible for maintaining integrity and safety of surrounding construction, in general, during work per the requirements of Section 02210 - Temporary Shoring and Bracing, at the same time following all applicable requirements of Section 02050 – Structural Dismantling.

E. Carefully remove the required stone while maintaining support to all surrounding and supported elements that are otherwise dependent upon the masonry being removed for support or stability. In the case of individual units that must be removed, limit sawcuts to joint lines in order not to damage the units.

   1. Carefully remove all stones by hand. Care should be taken not to cut the tops or bottom of the stones during disassembly or damage edges with prybars or other tools. Contractor to replace at no cost to the owner all units damaged during disassembly or reinstallation.

   2. Safely lower and/or transport, store and protect all salvaged units on- or off-site for re-use.

F. Following removal of the units, inspect the remaining masonry along cut lines and/or wythe (collar) joint lines and remove all loose mortar or leftover broken units to expose flat, uniform surface and/or detaching each unit's anchors to the back-up construction and to the adjacent units. Additionally remove and re-set any loose or shifted stone and notify the Engineer of any such conditions before proceeding.

G. Mechanically clean remaining surfaces and restore the exposed remaining masonry as needed per the requirements of this Section.

H. Protect the interior of the existing structure from the external weather and from dust and debris caused by these operations. Provide weather protection as needed until the external envelope of the building is restored.

3.3 CLEANING OF STONE

A. Perform cleaning to the standard established in the approved mockups.

B. Clean all stone units with Prosoco Light Duty Restoration Cleaner. Start with the most diluted concentration and progressively use stronger dilutions to achieve the desired cleaning.

C. Pre-wet surface with clean water.

D. Apply cleaner using a brush or roller. Scrub gently to improve results.

E. Let cleaner dwell for 10 minutes. Scrub gently heavily soiled areas. Do not let chemicals dry on the surface.

F. Rinse surface thoroughly with clean water using a low-pressure washer fitted with a 45-degree fan tip at no more than 400 psi. Power washer marks of any sort will not be acceptable.

G. Repeat cleaning where necessary to achieve level of cleaning established in approved mockups.

3.4 REPAIR OF ADJACENT AND BACK-UP MASONRY TO REMAIN

A. Remove all loose masonry units, mortar and residue from surface of back-up construction without disturbing or weakening or destabilizing the masonry. Employ a "pressure washer" and regulate the nozzle pressure to clean but not damage the surfaces. Nozzle pressure shall be in the range of 600 psi with a 15 degree fan at the tip.

B. Identify and remove loose units and re-set them with new mortar slushed into surrounding voids. Add stones as may be appropriate to re-stitch the wall to a sound, unfragmented condition.

1. Locate damaged and/or loose stone units to be removed. Pull unit(s) out of wall with a gentle rocking action, driving wedges into surrounding joints only as required to snap this joint off. Stones shall be removed one at a time.

C. Grout Injection of Cracks and Small Holes and Voids in Existing Masonry to Remain

1. The following pertains to grout injection of structural cracks of up to 2" in width.

2. Mechanically widen outer edges of structural cracks and drill ½" diameter holes at 6" to 12" o.c. and install grouting ports. Seal surface of crack and around ports. Leave bottom 4" of crack open and seal after water flushing. Removable Crack Seal for cementitious grouting shall be placed on both sides of the wall or crack to be injected.

3. Flood crack with water at 10 psi maximum pressure and allow deleterious materials and any sand or masonry residue to flow out at bottom. Seal remaining drainage opening at bottom of crack with removable Crack Seal for cementitious grouting.

4. Gravity feed into crack, starting at bottom and progressing upward until all ports are filled and plugged. Injection shall be performed within 30 minutes of water saturation but after all free water has run out. Injection pressure shall not exceed 10 psi. Lifts shall not exceed 36" in height.

5. Remove ports and removable Crack Seal and inspect penetration of crack. Begin remainder of restoration work if acceptable, or re-inject if not well penetrated.

D. Filling of Large Voids in Existing Masonry to Remain

1. Expose the core, cell or void as much as possible and provide a cleaning port at the top and bottom of the crack or void, or at 4" max. o.c. if greater. Flood crack with water at 10 psi maximum pressure and allow deleterious materials and any sand or masonry residue to flow out at bottom.

2. Hand rub cement paste slurry on surfaces against which to be filled, if possible, and fill the excavated void(s) by one or more of the following methods as may apply:

   a. Hand pack structural mortar into shallow voids and cracks between ¼" and 2" in width and less than 6" depth, adding small stone shards where the overall thickness of mortar exceeds 1".

   b. Form open sides and ports and gravity feed coarse grout into voids, hand tamping with a rod or wooden pole.

3. Limit lift heights to 36", allowing enough curing time between lifts for the grout to set to sufficient stiffness that it will not laterally load the sides against which it was placed, even when another lift is placed over it.

4. Work and vibrate wet grout with a thin rod during deposition, but do not over-work to the point that air bubbles or voids will form.

5. Form or strike exposed surfaces of grout fills 1" inside of liner surface to allow for final pointing. Clean surfaces of stones and surrounding work following each day's operations. Moist cure completed work for not less than 48 hours.

6. Clean surfaces of stones and surrounding work following each day's operations. Moist cure completed work for not less than 48 hours.

E. Inspect all joints and rake deteriorated or softened mortar joints to a minimum depth of 1", or as deeply as necessary to reach sound mortar, but not to exceed one half of the thickness of the joint without supplementary means of support. Employ tools that are sharp and will completely cut out joints at intersections without splitting or damaging stones. Drive hardwood shims into joints that will be cut more deeply than 1 ½" to prevent the wall construction from shifting. Cut joints shall match the approved sample patch.

F. Push the new pointing mortar into the joints, evacuating air bubbles with the sharp end of a trowel, and strike surface of joints to match existing surrounding joints. Provide "shed joints" to shed water away from horizontal projections that may otherwise collect water. Hold mortar back from Architecturally exposed surfaces by ½" to 1" to allow for final tuck of finished pointing mortar.

G. Moist-cure all work under a tarpaulin or plastic sheets. Following curing period, maintain weather protection to interior of structure until exterior wall system is replaced.

H. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

3.5 GROUT INJECTION VIA PRE-SET TUBES

A. Pressure test pre-set grouting tubes to determine whether the voids that they pass through are sealed or communicate with the others, which will affect the grouting operations into the pier.

B. Using the grouting tubes, pre-dampen the holes with steam or a fine spray mist and then inject void filling into the pier.

1. At sealed locations, deposit grout via separate smaller diameter tubes that are inserted into the pre-set tubes and allow air to bleed larger tubes. Push tube as far as possible into the tube and slowly withdraw during deposition, plugging the larger tube hole around the smaller upon back-up or refusal of grout.

2. At unsealed locations, deposit the grout via a sealed packer that is inserted into the face of the pre-set tube.

C. Proceed from port to port, bottom to top, monitoring the pier conditions and volume of flow. If the volume of consumed grout exceeds 10 percent of the total volume of pier, below the injection height, limit lift heights to not more than 36" between successive days, otherwise, limit lifts to 6-feet per day.

3.6 RE-SETTING OF STONEWORK

A. At bed joints, add lead shims as needed to help float large units without squeezing out the mortar. Install stone anchors at proper alignments and stack next courses of units properly over them. Incorporate cotton chord weeps as indicated below next courses' head joints and clean sloughed mortar off internal stone perches at voided construction to expose tops of lower courses and weeps. Tool the interior edge of the mortar bedding at cavities to provide "shed joints" at a 1:1 slope, keeping the weep extensions clear of mortar. Incorporate flashing where indicated, providing solid bedding below the flashing to minimize "oil canning".

B. At head joints, fill the gaps between stone ends solidly with mortar, using backer rods at the interior edges of cavity construction if needed. Add slate shims if greater than 1" thickness, in order to minimize shrinkage and sloughing.

C. At bonded collar joints, hand rub a mortar paste slurry over the contact surfaces of the stone to be set and pre-butter depressions which are deeper than 1/4" to provide a non-concave surface. After setting and adjusting the stone units, pack bonded collar joints with mortar, adding stone aggregate shims if greater than 1" in thickness to minimize sloughing and shrinkage. Aggregate shall be washed, moistened pea-stone if the joint is between 1" and 3" in width, and small loose stones of suitable size if joint width is greater than 3".

D. Stones shall be re-set to within ¼" of their previous positions and surface alignment, with individual joints' widths along all sides within 1/8" of their cumulative average width per stone.

E. Strike outer joints at a recessed depth of 2 ½ times the joints' widths from the surrounding masonry and provide dovetail transitions to existing surrounding joints and to those that are to be re-pointed or removed.

F. Finish point outer surfaces of the joints to match surrounding work after not less than 24 hours from the setting of the stones and filling of the joints.

G. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

3.7 PREPARATION OF JOINTS FOR REPOINTING

A. Rake mortar joints in existing construction in areas designated to be repointed to a minimum depth of 2.5 times the mortar joint width, 1", or as deeply as necessary to reach sound mortar (whichever is greatest), but not to exceed one half of the thickness of the stone thickness without supplementary means of support. Employ tools that are sharp and will completely cut out joints at intersections without splitting or damaging stones. Raking work shall match the approved test sample.

B. Gently drive wedges or hardwood shims into wide, deep cracks in masonry where there is a possibility that the vertical and in-plane lateral support of masonry work will be compromised during deep raking of the joints. This should at least be done where more than half of the length of a specific joint is removed to a depth of more than one third of the thickness of the stone.

C. Cut flashing reglets in new or existing masonry as indicated on the Contract Drawings.

D. Wire brush clean and then pre-wet the joints and allow for the existing mortar to dry or saturate to a dull, non-glossy finish immediately before applying new mortar.

E. Where applicable, lead-abate all immediate lead-painted masonry surface areas that will be affected by cutting and pointing work, prior to starting masonry operations.

3.8 MORTAR JOINT POINTING

A. Pre-wet prepared mortar joint surfaces until they are saturated but surface dry. At flashing reglets, verify that flashing has been fully installed and is stable.

B. At new or re-set masonry and deeply cut mortar joints Apply a 3/8" base lift of tuck pointing mortar, and allow to cure. Base lift shall have a struck recess for tuck-pointing to lock into.

C. Apply final "tuck" lift of pointing mortar, tooling joints to exactly match the existing joint profiles that are adjacent to the work.

D. Where so specified, point joints and beds with specified sealant after first installing the specified backup material and applying primer if required, all in strict accordance with the printed instructions of the sealant manufacturer. Test all sealants for compatibility prior to use. Tool all sealants to insure maximum adhesion to contact surfaces.

E. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.

F. Clean mortar from all surfaces following completion and curing of work.

G. Work under this subsection shall only be done when the ambient air, material, and substrate temperatures are above 40 degrees F. by 9:00 AM and rising.

H. The Contractor shall be responsible for matching the joints of the mock-up surrounding work and shall re-cut and replace any joints that are poorly formed or do not match the mock-up or the surrounding work, as determined by the Engineer, at the Contractor's own expense.

I. Moist cure all work, spraying with a water mist and cover with damp cloth or tarpaulin.

J. Chemically clean all surfaces following completion and curing of work, being careful to reveal the mortar aggregate but to not over-etch, weaken or discolor the mortar. Remove excess mortar from the surface before it sets using a bristle brush or by rubbing the surface with burlap or clean sand. If mortar is left on the surface, wash surface clean using dilute solutions of Hydroclean HT-455.

K. Completed work shall match approved sample patch or shall be re-done at the Contractor's expense.

3.9 CLEANING AND PROTECTIONOF COMPLETED MASONRY WORK

A. As work proceeds and upon completion, remove excess mortar, smears and droppings. Clean adjacent and adjoining surface of marks arising out of execution of work in this Section.

B. Sweep up and remove daily sand, cleaning compounds and mixtures, dirt, debris and rubbish. Sweep or flush away nightly, all residual washed materials. Keep the premises neat and clean at all times.

C. After installation and pointing are completed, carefully clean all surfaces of all dirt, excess mortar, grout splatter, stains and/or other site incident defacements. Clean soiled surfaces using a non-acidic solution that will not harm stone or adjacent materials. Consult stone fabricator for acceptable cleaners. Do not use wire brushes, acid or other solutions which may cause discoloration. Use nonmetallic tools in cleaning operation. Apply in accordance with cleaner manufacturer recommendations.

D. Mechanically remove all loose mortar and concrete splatter with hand tools without scratching, gouging or otherwise marring the existing substrate.

E. Chemically clean stone following completion of work, and where specifically specified on the drawings.

3.10 SETTING/ RE-SETTING TOLERANCES

A. Maximum Variation from Plane of Wall: 1/4" in 10 feet or as required by elevator clearances.

B. Maximum Variation from Plumb: 1/4" per story non-cumulative, 1/2" total, or as required by elevator clearances.

C. Maximum Variation from Level Coursing: 1/8" in 4 feet, 1/4" in 10 feet.

D. Maximum Variation of Joint Thickness: 1/8".

3.11 HIGH PRESSURE WATER REMOVAL OF PAINT AND MASONRY COATINGS

A. General

1. The work shall be performed at all exterior masonry locations.

2. Remove at least 95% of the paint and masonry coatings using high pressure water without damaging the face of granite stones.

3. Do not perform work unless the temperature is a minimum of 40°F and rising.

4. Paint removal may be performed during inclement weather provided the water, paint, and debris are contained.

B. Mock-Up

1. Prior to the start of the work the Contractor shall perform a test removal mock-up at a location designated by the Architect of a minimum 5' x 5' size to demonstrate the quality of the paint removal. The cleaning equipment shall be set at the approved operating pressure and flow rate.

END OF SECTION 04500

SECTION 04720 – CAST STONE FABRICATION

PART 1- GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. This section establishes criteria for materials, mixes and evaluations of Cast Stone (architectural precast concrete.) Dry Tamp Cast Stone or Vibrant Dry Tamp Cast Stone or, measurable slump cast stone not containing large and small aggregate in addition to sand and cement, shall not be accepted.

B. The Work of this Section includes all labor, materials, equipment and services such as field measuring, shop drawings, submittals etc necessary to complete the cast stone work as shown on the drawings and specified herein.

1.3 Related Work

A. MASONRY RESTORATION – SECTION 04500

1.4 QUALITY ASSURANCE

A. Cast stone fabricators must meet the following criteria:

1. Have successfully completed cast stone fabrication for Historic Preservation projects. (Wet poured, measureable slump cast stone projects only) Provide names of 5 projects, contact information, date completed and total quantity of units provided as well as the duration of the contract. Provide photographs of the completed projects.

2. The cast Stone fabricator must be a member of one of the following and meet their quality control standards:
   a) Precast/Prestressed Concrete Institute.
   b) Architectural Precast Association
   c) Cast Stone Institute

3. Must demonstrate experience with modeling, molding and casting architectural details. Provide the names of 3 projects, contact information, date completed and photographs of the completed works. This submittal can be part of the submittal requirement of 1.4 paragraph 1.

a. Include copies of material test reports for completed projects, indicating compliance of cast stone produced for these projects with ASTM C 1364 (include freeze-thaw test results. ASTM C-666)

4. Cast stone fabricator must have been in business for 10 plus years and have successfully completed projects in the northeastern United States. Provide number of years under the current Ownership.

B. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.

C. Codes and Standards: Comply with the following codes, specifications and standards, except as otherwise indicated. **If a conflict exists between the following codes, specifications and standards, the most stringent requirement shall apply. Most recent edition of standard shall apply unless otherwise noted:**

1. Cast Stone Institute Technical Manual
2. ASTM C 1364 – Standard Specification for Architectural Cast Stone.
3. ACI 318 – Building Code Requirements for Reinforced Concrete
4. ASTM C 150 – Standard Specification for Portland Cement
5. ASTM A 955 / A 955M – Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement
6. ASTM C 33 – Standard Specifications for Concrete Aggregates
7. ASTM C 979 – Standard Specification for Pigments for Integrally Colored Concrete
8. ASTM C 1194 – Compressive strength, 6,500 psi minimum for products at 28 days
9. ASTM C 1195 or ASTM C 642 – Absorption, 6% maximum for products at 28 days
10. ASTM C 173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method
11. ASTM C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
12. ASTM C 260 – Standard Specification for Air Entrained Admixtures for Concrete
13. ASTM C 426 – Standard Test Method for Linear Shrinkage of Concrete Masonry Units

14. ASTM C 494/C 494M – Standard Specification for Chemical Admixtures for Concrete.

15. ASTM C 666 – Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

16. ACI Monograph #8 "Precast Handling and Erection"

17. CRSI 59 "Recommended Practice for Placing Reinforced Bars."

18. PCI Manual MNL 117, Manual for quality Control for Plants and Production of Architectural Precast Concrete"

19. Massachusetts State Building Code, 8th Edition

D. Where provisions of codes and standards are in conflict, the most restrictive shall govern. Refer conflicts to Architect for a decision before continuing work.

E. Dry Fitting of Cast Stone Assemblies: Dry Fit all multipart cast stone assemblies to ensure that units will fit with each other and into existing masonry openings prior to shipping to jobsite. Submit photo-documentation of dry-fitted assemblies showing that the units fit with each other and that all profiles and details are in the proper alignment with ledges, overhangs or misalignments.

1.5 SUBMITTALS

A. Test Reports: Submit copies of all quality control reports and in house testing produced by the plant during casting of the units for this project. Submit results of in-house testing. Test reports to indicate date of casting, as well as slump, air entrainment, water absorption and compressive strength at 7 and 28 days.

B. Fabricator to keep, and periodically submit to owner, a list of which units were cast on each day of casting and then indicate the casting date on each of the units.

C. Product Data: Submit manufacturer's product data including all mill reports and specifications with application and installation instructions for proprietary materials and items including admixtures, bonding agents and all other materials.

D. Shop Drawings: Provide detailed drawings, properly checked and coordinated with the existing conditions, showing all details for the work including but not limited to, reinforcing, hoisting devices, inserts, anchors, built – in provisions for other work, unit sizes, joint and corner details, dimensions, profiles, formwork, jointing details and other information required for fabrication. Indicate finished faces for each type of unit.

E. Inventory Drawings: Submit Contractor's inventory drawings indicating each existing unit and its location. Inventory drawings may be combined with shop drawings.

F. Erection Drawings: Provide detailed drawings, properly checked and coordinated with the existing conditions and survey, and showing the position of each unit in the structure and all connections and attachments. Indicate setting benchmarks established from survey as well as overall dimensions derived from survey on erection drawings. Indicate that individual stones plus joints equals the total dimension for each bay established during the survey of existing cast stone unit. For items needed to be installed in other work, include setting diagrams, templates and instructions. Erection drawings may be combined with shop drawings.

G. Samples:

1. Submit as many 12" x 12" cast stone samples as required to match the existing cleaned, unweathered cast stone. Show the full range of colors, textures and finishes for the exposed surfaces. Samples may be selected at random and cut in half to expose the aggregates.

2. Before cast stone materials are delivered to the job site, submit one full sized cast stone unit of each type required, showing approved color, texture, profile and finish as well as all attachments and lifting devices. Obtain Architect's approval before continuing work. Approved units shall serve as control samples and criteria for acceptance of the work and may be incorporated into the finished project.

H. Qualification data: Manufacturer shall submit a written list of 5 (five) projects of similar scope along with contact information for building owner, architect and contractor references as described in Section 1.4 paragraphs 1 and 2. Architect reserves the right to approve cast stone fabricator.

1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364 (include freeze-thaw test results ASTM C-666.)

I. Certificate of Compliance: Provide notarized certificates indicating compliance with these specifications for all steel components and all other products and materials as required by the Architect.

1.6 DELIVERY, STORAGE AND HANDLING

A. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining.

2. Do not use padding, packaging or dunnage that may cause staining.

3. Move cast stone units, if required, using dollies with wood supports.

4. Store cast stone units on wood skids or pallets with non-staining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

B. Store installation materials on elevated platforms, under cover, and in a dry location.

C. Store units at plant in a location where the ambient temperature is 50 degrees F. or greater for a minimum of 28 days after casting.

D. PROTECTION:

1. Use all means necessary to protect cast stone and related materials before, during and after installation and to protect the installed work and materials of all other trades.

E. REPLACEMENTS: In the event of damage, immediately make all repairs and replacements necessary for Architect's approval, at no additional cost to the Owner.

1.7 COORDINATION

A. Coordinate production and delivery of cast stone with masonry restoration work to minimize the need for on-site storage and to avoid delaying the Work.

1.8 WARRANTY

A. Provide warranty signed by Contractor, Fabricator and Installer agreeing to repair or remove, replace and re-install (including access to work) at no additional cost to the owner all cast stone units that become defective within five years from date of substantial completion. Defective shall be defined as loss of surface detail, cracks, spalling, color changes, staining from reinforcement rod connections and other defects as determined by the project architect and/or an independent testing agency employed by the Owner.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CAST STONE

A. Comply with ASTM C 1364 as it applies to wet cast/measurable slump cast stone.

B. Physical properties: Provide the following:

1. Compressive Strength – ASTM C 1194: 6,500 psi (45 Mpa) minimum for products at 28 days.

2. Absorption – ASTM C 1195: 6% maximum by the cold weather method or 10% maximum by the boiling method for products at 28 days.

3. Air Content – ASTM C173 or C 231 shall be 5 – 7%

4. Freeze –Thaw – ASTM C 1364: The CPWL shall be less than 5% after 300 cycles of freezing and thawing.

5. Linear Shrinkage – ASTM C 426: Shrinkage shall not exceed 0.065%

6. Alkali Silica Testing (ASR) as per ASTM C33 for all aggregates used in the mix design.

C. Job Site Testing – One (1) sample from production units may be selected at random from each *shipment* delivered to the job site and contractor to have all required tests completed by an independent lab. Cost of testing to be paid by owner.

1. Three (3) field cut cube (2" x 2" x 2") specimens from each of these samples shall have an average minimum compression strength of not less than 85% with no single specimen testing less than 75% of design strength as allowed by ACI 318.

2. Three (3) field cut cube (2" x 2" x 2") specimens form each of these samples shall have an average maximum cold-water absorption of 6%.

3. Sixteen (16) field cut planks (16" x 4" x 3") (tolerance of +0 and – ¼") shall have a cumulative percentage weight loss (CPWL) of less than 5% after 300 cycles of freezing and thawing when tested as per modified ASTM C666 procedure A.

4. Field Specimens shall be tested in accordance with ASTM C 1194, C1195 and C666 (modified for cast stone).

D. The samples shall be approved by the Architect before the manufacturer shall be allowed to proceed with the work.

E. Exposed surfaces, unless otherwise specified, shall exhibit a typically fine grained texture similar to natural sandstone. No bug holes shall be permitted.

2.2 RAW MATERIALS

A. Portland cement – ASTM C 150 Type 1, containing not more than 0.60 percent total alkali when tested according to ASTM C114.

B. Coarse Aggregates – Granite, quartz or limestone, ASTM C 33, except for gradation. Aggregate color to be close to the color of the existing cast stone that is being replicated.

C. Fine aggregates – Manufactured or natural sands, ASTM C 33 except for gradation.

D. Colors – Inorganic iron oxide pigments, ASTM C 979 except that carbon black pigments shall not be used. All pigments shall be guaranteed by the manufacturer to be light fast and lime proof.

E. Admixtures: Comply with the following:

1. ASTM C 260 for air entraining admixtures. Certified by the manufacturer to be compatible with other admixtures used.

    a. Add to mixes for all units at manufacturer's prescribed rate to result in an air content of 5 to 7 percent.

2. ASTM C 494/C 495 M Types A – G for water reducing, retarding, accelerating as long as admixtures do not detract from other properties or from the long term durability of the finished product.

3. Other admixtures such as integral water repellents and other chemicals for which no ASTM standards exist shall not be used without written consent of the Project Architect.

4. ASTM C 618 mineral admixtures of dark and variable colors shall not be used.

5. ASTM C 989 granulated blast furnace slag shall not be used without written consent of the project architect.

F. Water: Shall be potable and free of minerals and/or other impurities that might adversely affect the color, durability or long term stability of the finished product.

G. Reinforcing bars:

1. ASTM A955/A995M "Deformed and Plain Stainless Steel Bars for Concrete Reinforcement".

2. Welded Wire Fabric: Stainless Steel welded wire fabric complying with ACI 318-99.

3. Reinforcing bar sizes shall be as shown on approved shop drawings. The material covering in all cases shall be at least twice the diameter of the bars. Stone shall be fully reinforced to take all stresses including handling, temperature changes, horizontal and vertical loads and structural stresses.

H. All anchors, dowels and other anchoring devices shall be stainless steel Type 304. Shims shall be stainless steel or plastic designed specifically for setting stone/cast stone.

I. Reinforcement Accessories: Provide spacers, chairs, bolsters, chair bars, ties, clips and other accessories as needed to properly place and support reinforcement.

J. Tie Wire: Provide stainless steel wire of sufficient strength for intended purpose; provide 18 gauge minimum wire or ties manufactured from other non staining, non corroding, durable materials.

2.3 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C1364 MANUFACTURED FROM MEASURABLE SLUMP CONCRETE. DRY TAMP, VIBRANT DRY TAMP OR ZERO SLUMP CONCRETE WILL NOT BE ACCEPTED.

B. PROVIDE UNITS THAT ARE RESISTANT TO FREEZING AND THAWING AS DETERMINED BY LABORATORY TESTING ACCORDING TO ASTM C666.

C. All Cast Stone used in this work shall have a minimum compressive strength of six thousand five hundred (6,500) lbs. per square inch and absorption of not greater than five (5) percent when tested in accordance with ACI 704.

D. Absorption: 6 percent maximum at 28 days, per ASTM C 1195 or ASTM C 642.

E. Reinforce units as indicated and as required by ASTM C1364 and as required for handling, temperature changes, horizontal and vertical loads and structural stresses. Use Stainless Steel reinforcement.

F. Fabricate units with sharp arris and details accurately reproduced. All units to have approved textures and finishes on all exposed surfaces.

1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.

2. Provide drips on projecting elements, unless otherwise indicated.

3. Provide anchor rebates where required to ensure tight masonry setting joints. Provide false joints where indicated on approved shop tickets.

G. Casting Tolerances: Maintain casting, bowing, warping and dimension tolerance to within the following:

1. Overall dimension for height, width and length of units: Plus zero of unit dimension to minus 1/8" in each direction.

2. Bowing or warping: Not to exceed 1/360 of the span.

2.4 MOLDS, PATTERNS AND FORMS

A. Certain changes in profile, section and wash may be required in the model/pattern phase in order to improve the durability and water shedding capability of the original units or to match the original finishes. Do not combine separate units into single units except where indicated on contract drawings without written approval of the project architect.

B. All models and patterns shall be prepared by skilled craftsmen in a correct and artistic manner in strict accordance with the spirit and intent of the original units and the contract drawings. Models shall be approved by Architect before any work is executed from them.

C. All patterns and models for the sculptural and decorative elements shall be modeled by a trained sculptor from the evidence provided from the existing weathered units. Do not proceed with mold making until the patterns and models of the decorative units have been approved by the architect.

D. Provide forms and molds as required to produce finished surfaces. Accurately construct forms that are mortar tight and of sufficient strength to provide cast stone units of shape, lines and sizes shown.

E. Where the surfaces and finishes on the existing units are missing or too weathered to make molds from that accurately reproduce the dimensions, profiles and finishes of the original units in their unweathered state, new patterns shall be made that recreate the profiles, finishes and dimensions of the original units.

F. Inform project architect when patterns and production molds are complete and ready for inspection. Do not begin production run of cast stone until patterns and molds have been inspected by the project architect. Make any required changes to patterns or molds that arise from Architect's Inspection.

2.5 COLOR AND FINISH

A. New cast stone units shall match the color, surface texture and finishes of the original unweathered and cleaned cast stone. Contractor will be required to clean representative sections of the original sandstone so that target match areas can be indicated by Project Architect.

B. There shall be no air voids on the surface of either type of cast stone in excess of 1/32 in. (0.8mm) and the density of such voids shall less than 3 in any 1 inch squared and not obvious under direct daylight illumination when viewed a distance of 10 feet.

C. Units shall match color and texture of approved samples when viewed at a distance of 10 feet.

D. Project Architect will have the final say as to acceptability of the appearance of cast stone units.

2.6 REINFORCING

A. Reinforce the units as required by the approved shop drawings and for safe handling, horizontal and vertical loads, and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross section area.

C. All reinforcing shall have a minimum cover of twice the diameter of the bars.

D. Reinforcing and connecting when shown on contract drawings shall be considered minimum reinforcing or requirements.

2.7 CURING

A. Maintain an ambient temperature between 60 deg. F and 160. F during curing. Cover units with a vapor tight membrane to maintain 100% relative humidity for initial cure.

B. Additional yard curing to be 350 day-degrees (i.e. 5 days at 70 deg. F or 6 days at 60 deg. F etc)

C. Store units in a space with an ambient temperature above 50 deg. F for a minimum of 28 days.

D. For units produced during the fall, winter or early spring – store units after curing in a location where the temperature will be above freezing.

2.8 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than ±1/8 in. (3mm) from approved dimensions.

B. Length of units shall not deviate by more than length/ 360 or ±1/8 in. (3 mm), whichever is greater, not to exceed ±1/4 in. (6 mm).

1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp, bow or twist of units shall not exceed length/ 360 or ±1/8 in. (3 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features – On formed sides of unit, 1/8 in. (3 mm), on unformed sides of unit, 3/8in. (9 mm) maximum deviation.

2.9 PRODUCTION QUALITY CONTROL

A. Prepare design mixes for each type and strength of concrete. Use an independent testing engineer acceptable to Architect for preparing and reporting proposed mix design.

B. Proportion mixes by either laboratory trial batch or field experience methods as specified in ACI 301, using materials to be employed on the project. For each proposed mix design provide the following:

1. Complete identification of aggregate source supply.

2. Test reports for compliance with specified requirements.

3. Scale weight of each aggregate.

4. Absorbed water in each aggregate.

5. Brand, type and composition of cement.

6. Brand, type and amount of each admixture.

7. Amounts of water used in trial mixes.

8. Water/cement ratio (include liquid admixtures in calculation)

9. Proportions of each material pre cubic yard.

10. Gross weight and yield type per cubic yard of trial mixtures.

11. Measured slump.

12. Measured air content.

13. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7 and 28 day test, for each mix design.

14. Water absorption of Concrete. (Test twice weekly in compliance with ASTM C 97)

15. Freeze/Thaw test (Test in compliance with ASTM C666, Procedure A, 300 cycles)

2.10 DELIVERY, STORAGE AND HANDLING

A. After full cure has been achieved, store units at plant during winter in a controlled environment where the ambient temperature does not go below freezing.

B. Mark production units with the identification marks as shown on the shop drawings.

C. Package units and protect them from staining or damage during shipping and storage.

D. Provide an itemized list of product to support the bill of lading.

PART 3 - EXECUTION

3.1 DESIGN AND FABRICATION

A. Design precast units to withstand all stresses and loading conditions required by referenced and applicable codes and standards.

3.2. EXAMINATION

A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

B. Install units as per Specification Section 04721

-END OF SECTION 04720-

SECTION 04721 – CAST STONE INSTALLATION

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the stone installation work as shown on the drawings and specified herein, including but not necessarily limited to the following:

1. Survey of structure to establish all dimensions that are required to properly match the existing cast stone units and assemblies as well as all benchmarks that are required for setting of replacement cast stone units. Benchmarks and overall dimensions from survey to be indicated on setting drawings. In addition, contractor to place markers on structure to indicate location of critical benchmarks to demonstrate during architect's site visits that installation conforms to setting tolerances and original position of units.

2. Removal of cast stone units where indicated on the contract drawings and installation of new cast stone units.

3. All necessary protection and precautions to protect adjacent surfaces and pedestrians.

4. Removal of all old pointing, setting and parging mortars and anchors from adjacent units that are not scheduled to be removed.

5. Pointing of new cast stone mortar joints after setting mortar has been raked out.

1.3 RELATED WORK

A. MASONRY RESTORATION – SECTION 04500

B. CAST STONE FABRICATION – SECTION 04720

1.4 QUALITY ASSURANCE:

A. Preservation Specialist:

1. Work of this Section must be performed by an experienced stone preservation firm that meets the criteria set out for the mason in the Masonry Restoration Specifications 04500

2. Field Supervision: Preservation specialist firm shall maintain an experienced full-time supervisor on the Project site during all times that stone restoration work is in progress.

3. Engineering Services: See Cast Stone Fabrication – 04720

4. Dry Setting of Cast Stone Assemblies in Plant to Verify Manufacturing and Setting Tolerances: See Cast Stone Fabrication – 04720

B. Field-Constructed Mockups: Contractor shall prepare the following sample panels on the structure where directed by the Architect. Obtain Architect's acceptance of visual qualities before proceeding with the work. Retain all mockups in undisturbed condition, suitably marked, during construction as standards for judging completed work.

1. Prepare sample panels of representative cast stone setting. Erect mock-up panels into an existing wall, as directed by Architect, to demonstrate quality of materials and workmanship.

a. The Contractor shall install mockups of each of the various setting conditions after award of the Contract and prior to the commencing of all work.

b. No work shall commence on the installation of the mockups until all appropriate cast stone samples have been approved.

c. The location of the mockups shall be selected by the Architect and shall include conditions to be anticipated during the full scope of the project.

d. After approval the completed mock-ups shall be an integral part of the finished work.

C. Source of Materials: Obtain materials for masonry preservation from a single source for each type of material required (cement, sand, pigment etc.) to ensure match of quality, color, pattern, and texture.

1.5 SUBMITTALS:

A. Cast Stone Removal and Setting Program:

1. Submit written program for each phase of stone setting. Describe in detail materials, methods and equipment to be used for each phase of work, including hoisting and rigging. Describe in writing the sequence for cast stone removal. Describe in writing the sequence of cast stone setting.

B. Product Data: Submit manufacturers' technical data for each product indicated including recommendations for their application and use. Include test reports and certifications substantiating that products comply with requirements.

C. Samples: Submit, for verification purposes, prior to mock-up erection, three samples each of the following:

1. Each type of anchor.

2. Each type of adhesive.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials to site in manufacturer's original and unopened containers and packaging, bearing labels as to type and names of products and manufacturers.

B. Protect masonry restoration materials during storage and construction from wetting by rain, snow or ground water, and from staining or intermixture with earth or other types of materials.

Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

C. Protect grout and other materials from deterioration by moisture and temperature. Store in a dry location or in waterproof containers. Keep containers tightly closed and away from open flames. Protect liquid components from freezing. Comply with manufacturer's recommendations for minimum and maximum temperature requirements for storage.

D. Store materials on site only as needed for work to be performed during the week. Maintain storage off-site for long-term storage of materials.

1.7 PROJECT CONDITIONS:

A. Hot-Weather Requirements: Protect restoration work when temperature and humidity conditions produce excessive evaporation of water from mortar and patching materials. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 90 deg F (32 deg C) and above.

B. Protect ledges and projections from mortar droppings.

C. Remove and replace masonry elements in a sequence that will not impair the strength, stability or water tightness of the remaining structure. Provide temporary shoring as required.

1.8 SAFETY PRECAUTIONS:

A. Dust Control Program: Prior to commencing masonry restoration work, Contractor shall submit for review a program for control of stone dust, water runoff, etc. during stone replacement operations.

B. Protect all surfaces outside scope of contract from damage during course of work.

C. Flammable materials shall be kept away from fire or flame. Provide portable extinguishers at job site for emergency use. Remove used containers, rags, and packaging from site each day.

D. All containers at job site shall be properly labeled indicating contents.

E. Maintain at job site Material Safety Data Sheets for all materials used.

F. Portable emergency eye wash equipment and first aid kit shall be kept on site.

G. Comply with applicable federal, state, and local environmental regulations regarding testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous waste.

1.10 ENGINEERING SERVICES

A. The Contractor shall provide engineering services of a Professional Engineer, who is registered as a structural engineer in the Commonwealth of Massachusetts, and who shall structurally design and assume professional responsibility for cast stone units and all connections required to handle, erect, and attach cast stone to the structure as well as any temporary shoring of the existing masonry. Reinforcing and connections when shown on the contract drawings shall be considered minimum reinforcing required. Submit shop drawings with calculations stamped by a Professional Engineer, indicating the design of cast stone and all connections showing compliance with these specifications.

PART 2 – PRODUCTS

2.1 MORTARS AND GROUTS FOR SETTING CAST STONE:

A. Mortar Materials:

1. Portland Cement: ASTM C 150, Type I.

2. Hydrated Lime: ASTM C 207, Type S.

3. Aggregate for Mortar: ASTM C 144, unless otherwise indicated.

4. Match size, texture and gradation of existing mortar as closely as possible.

5. Water: Clean, free of oils, acids, alkalis and organic matter.

6. No calcium chloride or admixtures containing calcium chloride shall be used in the mortar.

B. Setting Mortar Mixes:

1. General:

a. Measurement and Mixing: Measure cementitious and aggregate material in a dry condition by volume or equivalent weight. Do not measure by shovel; use known measure. Mix materials in a clean mechanical batch mixer.

b. Mixing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Then mix again adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for 1-to-2 hours. Add remaining water in small portions until mortar of desired consistency is reached. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

2. Do not use admixtures of any kind in mortar without written approval of project architect.

3. Mortar Proportions:

Mortar for Setting Cast Stone: Type N mortar, in accordance with ASTM C270, 1 part white Portland cement, 1 part lime, 6 parts colored mortar aggregate.

2.2 ANCHOR MATERIALS

A. Adhesive Anchors shall consist of a threaded anchor rod, a cylindrical wire mesh screen tube, and an injectible adhesive material. Injection adhesive system shall be HIT HY20 as manufactured by Hilti, Inc. Tulsa OK. or approved equal. 3/8" minimum diameter and 6" minimum embedment (3" embedment into each stone or 6" embedment into existing masonry backup.) Factor of safety: Tension – 6, shear – 4.

B. Anchor rods and flat stock shall be stainless steel Type 304 of dimensions specified, meeting the requirements of ASTM F-593 (condition CW). The minimum thickness of a strap shall be 1/8" and the minimum width shall be 1 ½".

2.3 JOINT SEALANTS

A. Two part urethane sealant by Tremco, Sika or Pecora

2.4 JOINT SEALANT BACKING

A. General: Provide Sealant backings of material and type that are non-staining, are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer baed on field experience and laboratory testing.

B. Elastomeric Tubing Sealant Backings: Closed cell backer rod complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg. F. Provide products wtih low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

PART 3 - EXECUTION

3.1 GENERAL

A. Protect persons, motor vehicles, surrounding surfaces, construction site, and surroundings from damage or injury resulting from masonry restoration work.

B. Erect temporary protection at pedestrian walkways and at points of entrance and exit for persons and vehicles that must remain in operation during course of masonry restoration work.

C. Dispose of run-off from rinsing operations by legal means. Protect waterways from contamination.

D. Dry brush, scrape or blow off all large accumulation of dirt and foreign material from ledges and dispose in a legal matter.

3.2 INSPECTION

A. Prior to the removal of the existing cast units, the Contractor shall verify all locations where cast stone is scheduled for removal. The contractor shall notify Architect in writing if conditions in the field differ from those indicated on the Contract Documents or cast stone shop drawings.

B. Prior to the removal of existing cast stone units, the Contractor shall survey structure to establish overall dimensions as well as benchmarks for setting of replacement cast stone units. Benchmarks and overall dimensions from survey to be indicated on setting drawings. In addition, contractor to place markers on structure to indicate location of critical benchmarks to demonstrate during architect's site visits that installation conforms to setting tolerances and original position of units.

C. Examine masonry installation areas and conditions and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

D. Remove mortar, loose particles, old patches and debris from existing surrounding masonry in preparation for replacement. Clean with stiff brushes or by flushing with water and compressed air.

3.3 CAST STONE REMOVAL AND REPLACEMENT:

A. Carefully remove by hand at locations indicated, or as directed by the Architect, any masonry units which are scheduled for removal. Cut out full units from joint-to-joint and in manner to permit installation of full size replacement cast stone units. Remove units without damaging surrounding masonry. Maintain adjoining construction in an undamaged condition.

3.4 CAST STONE INSTALLATION:

A. General: All masonry shall be erected level, plumb, square and true within the allowable tolerances established by approved setting mock ups. Set new and replacement masonry so that all critical benchmarks derived from the survey of the existing masonry are met and the masonry installation faithfully duplicates the original masonry in terms of overall dimensions, position of individual units and original setting tolerances. The units are to be positioned in such a manner that no dimensional error is allowed to occur. Horizontal and vertical joints shall be correctly aligned and uniform joint width shall be maintained. Plastic shims that are placed at the bed joints to assure proper joint size, must be left projecting past the face for easy removal after grouting but prior to pointing.

B. Drill new horizontal and vertical holes into the new stone unit and into the existing masonry back up to the specified depth. The drilled holes shall be blown clean of drill dust with an air gun.

C. Tape around hole to prevent spillage of adhesive onto face of masonry.

D. Install the Hilti HIT HY20 Fastener System into the masonry backup, per the Manufacturer's specifications. The stainless steel threaded rod shall be cleaned and degreased as necessary to remove all contaminants that may hinder the adhesive

bond, prior to installation. Comply with manufacturer's requirements for adhesive curing time.

E. All surfaces that are in contact with adhesive must be free of dirt or dust, paint, glaze, grease, oil, rust, or other contaminant. Surface may be dry or damp (no free water). The adhesive shall come in contact with clean sound surfaces.

F. Fill drilled hole in new stone unit with grout and align with threaded rod in backup. Spread unit with a full bed of mortar at back, top, and bottom of unit and install in the position to which it is assigned in accordance with the approved setting drawings.

3.5 POINTING OF MORTAR JOINTS

A. Rake out mortar used for setting stones before it sets and point joints with approved pointing mortar.

B. Rake out setting mortar to 2.5 times the joint width or 1.25 inches – whichever is greater. For butter joints (joints 1/8" and less) – rake out mortar to a minimum of .75 inches

3.6 MORTAR APPLICATION:

A. First layer to create a uniform depth for later applications and to be thoroughly compacted into cavities: apply mortar to a maximum thickness of 3/8"

B. After joints have been filled to a uniform depth, apply remaining mortar in successive ¼" thick layers: fully compact each layer and allow to dry to thumbprint hardness before applying next layer.

C. When final layer is thumbprint hard, tool to match approved sample joint.

D. Avoid feather-edging of mortar joint.

E. Immediately after repointing, remove excess mortar by light brushing with a natural bristle brush. Do not leave encrusted matter.

F. Fine mist mortar joint as required to keep mortar damp during curing. Keep mortar joint damp and protected for at least 72 hours after pointing to permit proper hardening of mortar.

3.7 CLEANING AFTER POINTING

A. The face of all stonework shall be thoroughly cleaned after completion of the pointing and other work liable to soil the stone. The stonework shall be gone over and any mortar splashes or smears shall be carefully removed from the surface with scrapers.

B. The cleaning shall be done with clean water applied vigorously with fiber brushes. After cleaning with brushes the stone shall be thoroughly rinsed with clear water. Proprietary cleaning compounds containing caustic agents, intended for removing mortar smears shall not be used without the written approval of the Architect. The goal is to remove all smears before they set so that caustic agents are not required.

3.8 JOINT SEALANT APPLICATION

A. Surface cleaning of joints: clean out joints immediately before installing joint sealants to comply with manufacturer's written instructions and the following:

1. Remove all foreign material that could interfere with adhesion of joint sealant.
2. Clean porous joint substrates to produce a clean sound substrate capable of developing optimum bond with sealant.

B. Install sealants per manufacturer's instructions.

C. Remove excess sealant from surfaces adjacent to joints.

D. Provide concave joint configuration per Figure 5A in ASTM C 1193.

E. Sanded Joints: Apply sand from pointing mortar to uncured joints and press into sealant to match appearance of mortar joints.

-END OF SECTION 04721-